

Estimated Impacts of Number of Years of Preschool Attendance on Vocabulary, Literacy and Math Skills at Kindergarten Entry

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Abstract

This study estimates the effects of attending preschool for one or two years on measures of early vocabulary development, literacy and math skills shortly after children entered kindergarten. A sample of 1372 kindergartners from 21 of New Jersey's "Abbott" school districts was assessed at the beginning of the school year. School records were used to determine whether children attended the state-funded preschool program, and if so, whether they attended preschool for one year at age 4, or two years beginning at age 3. New Jersey's Abbott districts have high levels of poverty, and many children are from immigrant and language-minority families.

Analyses of covariance were conducted that control for children's age, gender, ethnicity, primary language, district size, and poverty level. For vocabulary growth we find that 2 years of preschool significantly increases children's vocabulary over scores for children who did not attend, but the effects of 1 year at age 4 are not statistically significant. For both print awareness skills and math skills we find statistically significant increases for children who attended for 1 or 2 years over children who did not attend. However, while children who attended preschool for 2 years have slightly higher scores than children who attended only 1 year, those scores were not statistically significantly higher.

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Introduction

A question of current interest in the national discussion on the availability, cost, quality and effectiveness of preschool programs for young children is how much more children might gain from beginning preschool education at three years old rather than waiting until age four. Especially for preschoolers at risk of poor developmental and school outcomes due to poverty, the question is an important one. This study investigates the relative effects of years of preschool on entering kindergartner's academic skills (receptive vocabulary, phonological awareness, print awareness and early math skills) in a sample of preschoolers living in high-poverty school districts. Early receptive vocabulary is well known as an important underlying construct, broadly correlated to subsequent academic success. Early phonological awareness and print awareness are predictive of subsequent reading skill (National Research Council, 1998). Early math skills have been least studied, but recent research indicates the importance of early math skills to subsequent school success in math and more generally (Clements & Sarama, 2004). Most state funding for preschool education is limited entirely or almost entirely to programs for 4-year-olds. New Jersey's Abbott district preschool program, the subject of this study, is a rare exception in providing services to large numbers of children at age three.

Sample

Sample children were randomly selected from 21 of the 31 Abbott districts in New Jersey. The 21-district sample was randomly selected to proportionally represent small, medium and large districts from urban and rural settings, and to include a proportional number of districts with high percentages of Spanish-speaking children. The Abbott preschool program is one of the best-funded preschool programs in the country, with correspondingly high standards for program quality. Actual classroom quality has been increasing each year since the beginning of the program in 1998; average scores during the 2005-06 school year on the Early Childhood Environmental Rating Scale – Revised (ECERS-R; Harms, Clifford and Cryer, 1999) averaged nearly 5 on a scale of 1 to 7 (Lamy & Frede, 2005). The total sample of kindergartners analyzed in this study is 1372. The number of kindergartners with no preschool experience is 256; one year of preschool - 486; and two years of preschool - 630.

Instrumentation

Receptive Vocabulary

Children's receptive vocabulary was measured using the Peabody Picture Vocabulary Test, 3rd Edition (PPVT-3) (Dunn & Dunn, 1997) and for Spanish-speakers the Test de Vocabulario en Imagenes Peabody (TVIP) (Dunn, Padilla, Lugo & Dunn, 1986). The

PPVT is commonly used as quick test of IQ and can be used as a rough assessment of general cognitive abilities. The PPVT is a direct measure of vocabulary size and the rank order of item difficulties is highly correlated with the frequency with which words are used in spoken and written language. The test is adaptive (to avoid floor and ceiling problems), establishing a floor below which the child is assumed to know all the answers and a ceiling above which the child is assumed to know none of the answers. Reliability is good as judged by either split-half reliabilities or test-retest reliabilities. The TVIP is appropriate for measuring growth in Spanish vocabulary for bilingual students and for monolingual Spanish speakers. Standard scores are reported.

Mathematical Skills

Children's early mathematical skills were measured with the Woodcock-Johnson Tests of Achievement, 3rd Edition (Woodcock, McGrew & Mather, 2001) Subtest 10 Applied Problems. For Spanish-speakers the Bateria Woodcock-Munoz Pruebas de Aprovechamiento – Revisado (Woodcock & Munoz, 1990) Prueba 25 Problemas Aplicados was used. Subtests of the Woodcock-Johnson are reported to have good reliability. Standard scores are reported.

Phonological Skills and Print Awareness

Phonological skills development was measured using the Blending subtest of the Preschool Comprehensive Test of Phonological & Print Processing (Pre-CTOPPP; Lonigan, Wagner, Torgeson & Rashotte, n.p.) The Pre-CTOPPP was designed as a downward extension of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgeson & Rashotte, 1999), which measures phonological sensitivity in elementary school-aged children. Although not yet published, the Pre-CTOPPP has been used with middle-income and low-income samples and includes a Spanish version. As the Pre-CTOPP has only been very recently developed, very little technical information is available about its performance and psychometric properties.

The Blending subtest includes items that measure whether children can blend initial phonemes onto one-syllable words, initial syllables onto two-syllable words, and ending phonemes onto one-syllable words. The percentage of items the child answered correctly out of the 21 total subtest items is reported.

Print Awareness was measured using the Print Awareness subtest of the Pre-CTOPPP. Items measure whether children recognize individual letters and letter-sound correspondences, and whether they differentiate words in print from pictures and other symbols. The percentage of items answered correctly out of the 36 total subtest items is reported.

Analyses

For each of the outcome measures, ANCOVA was performed with the children's preschool status (0, 1 or 2 years of preschool) as the independent variable, including the

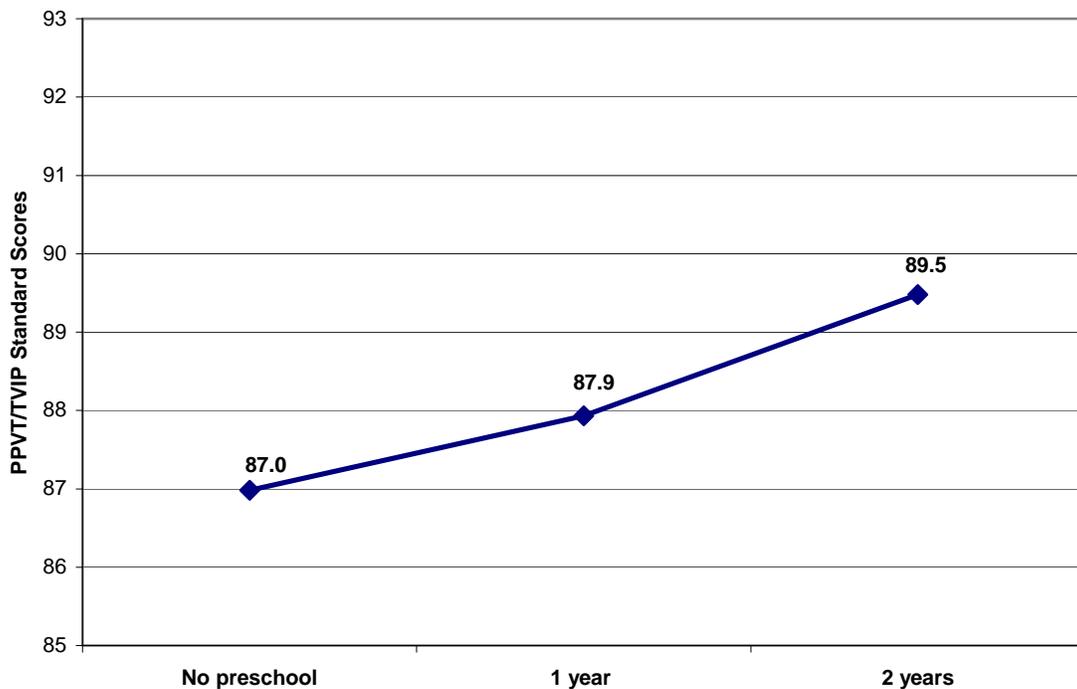
following covariates: the child's chronological age, gender and ethnicity; whether the assessment was done in English or Spanish; the size of the school district as determined by enrollment, and the relative poverty of the school district, as determined by the percentage of students receiving free or reduced price lunch. For standardized tests, standard scores are reported. For non-standardized tests, percentage of items correct is reported.

Results

Receptive Vocabulary

The increase in kindergartners' receptive vocabulary scores is significant for two years of preschool but not for just one year. Attending preschool for one year at four years old increased sample children's scores by an average of almost 1 standard score point (.95) over the average score for sample children who did not attend, a statistically nonsignificant increase. However, attending preschool for two years, at both three and four years old, increased children's scores by an average 2.5 standard scores points over the average score of children who did not attend, which is a statistically significant increase. See Figure 1 below.

Figure 1. Receptive Vocabulary Scores for Kindergartners with 0, 1 or 2 Years of Preschool



Phonological Awareness

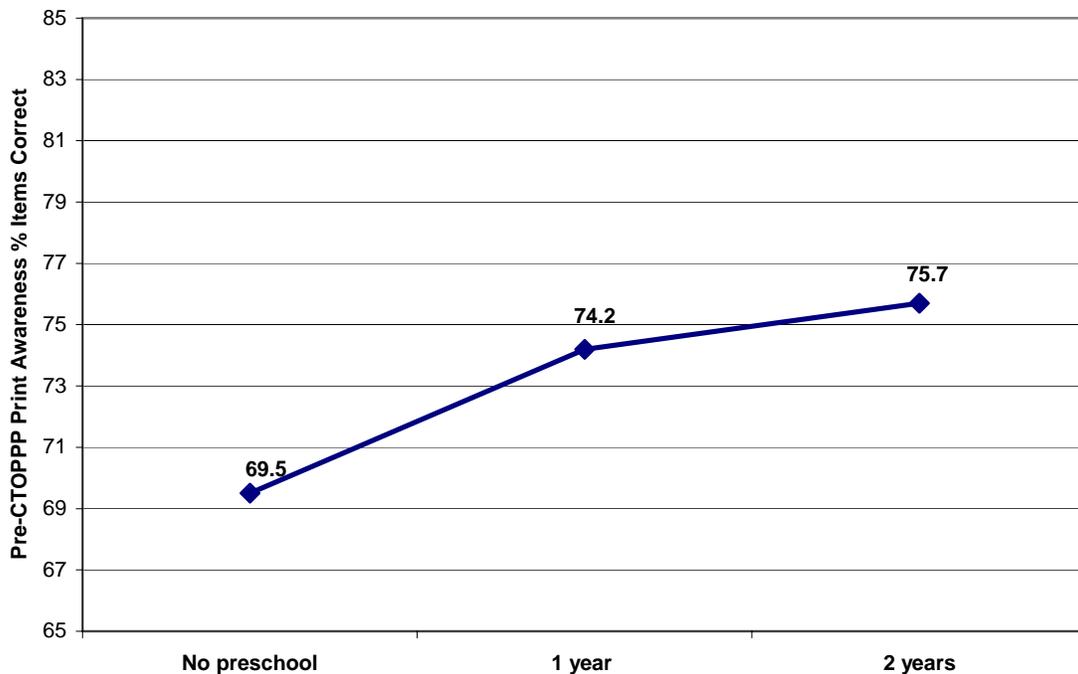
Results for kindergartners' phonological awareness scores as measured by the Pre-CTOPPP Blending subtest indicate that years of preschool did not significantly increase children's scores.

Print Awareness

Kindergartners' print awareness scores as measured by the Pre-CTOPPP Print Awareness subtest are significantly increased over average scores for children who did not attend, both by one year of preschool at 4 years old and by 2 years at both 3 and 4. However, the increase between 1 and 2 years of preschool is not statistically significant.

Attending preschool for 1 year at 4 years old increased sample kindergartner's scores by an average 4.7 percent of items correct over the average for kindergartners who did not attend. Attending preschool for 2 years, at both 3 and 4 years old, increased children's scores by an average 6.2 percent of items correct over the average of children who did not attend. The 1.5 percent increase between 1 and 2 years of preschool is statistically nonsignificant. See Figure 2 below.

Figure 2. Print Awareness Scores for Kindergartners with 0, 1 or 2 Years of Preschool



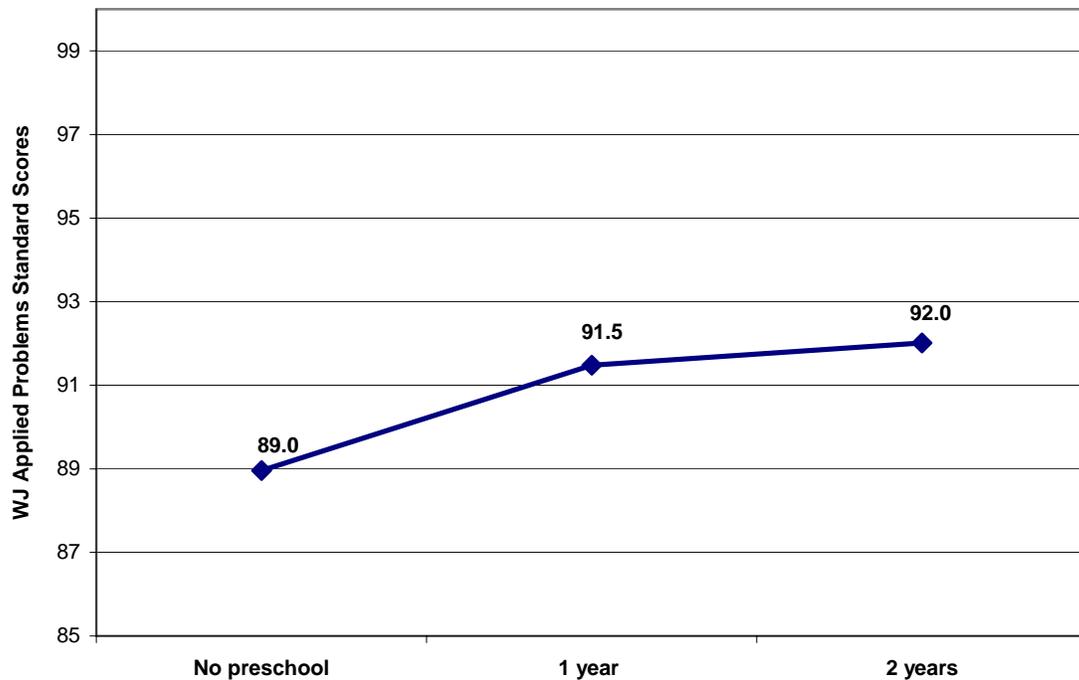
Math Skills

Results for math skills are similar to the results found for print awareness.

Kindergartners' math scores as measured by the Woodcock-Johnson Applied Problems subtest or the Spanish version of the test, are significantly increased over average scores for children who did not attend, both by 1 year of preschool at 4 years old and by 2 years at both 3 and 4. Here again, 2 years of preschool does not yield a statistically significant increase over 1 year of preschool.

Attending preschool for 1 year at 4 years old increased sample kindergartner's scores on the math test by an average 2.5 standard score points over the average for kindergartners who did not attend. Attending preschool for 2 years, at both 3 and 4 years old, increased children's scores by an average of just over 3 standard score points over the average of children who did not attend. The half point increase between 1 and 2 years of preschool is statistically nonsignificant. See Figure 3 below.

Figure 3. Math Scores for Kindergartners with 0, 1 or 2 Years of Preschool



Discussion

The findings of this study indicate that by starting earlier preschool education programs can have larger impacts on the development of children's vocabulary, at least for children from disadvantaged backgrounds. This finding is particularly important given current thinking about the contribution of early vocabulary development to children's capacity for subsequent learning (Hirsch, 2006). The idea is that the earlier a child knows more –

more words, more concepts - the more time they have with which to learn something else, and the broader a foundation they have from which to build more knowledge. The earlier a child learns words, the greater the conceptual basis for later learning more generally. In this case the advantage of a high-quality preschool experience at 3 years old, where adults support and extend children's early vocabulary and conceptual knowledge in appropriate ways, is apparent.

Findings for print awareness and early math skills suggest that other processes are at work. Children who started preschool at 3 years old scored just slightly higher on these measures at kindergarten entry than children who started a year later at 4 years old, but the increase in scores was not statistically significant. This suggests that an earlier start did not produce much of an effect for print awareness or math skill development at the start of kindergarten, and that a later start in preschool will not undermine short-term development in these areas. Print awareness skills and math skills are narrower in scope than vocabulary development and so perhaps are more quickly learned, or are more easily taught. Alternatively, it may be that the preschool classrooms these children attended need to improve their approach or intensify their efforts to help children improve these skills at age three. Other studies have suggested that little effort is devoted to math education in preschool programs. These findings have implications for early childhood curriculum and professional development.

No statistically significant effect of preschool was found for children's phonological awareness. This could be due to the nature of the preschool program; earlier research has shown that preschool classrooms in the Abbott districts are weakest in the area of support for children's phonological development (Lamy & Frede, 2005). However, NIEER's larger study of the effects of 5 state preschool programs found no effect of any of the other 4 state programs on this measure either. As this is a newly developed measure, it is possible that the lack of effects on this outcome is due to limitations of the Blending subtest.

It must be noted that the design of this study controls for selection bias only through the inclusion of child and district characteristics in the analyses. We included all of the characteristics of the children available (chronological age, gender, ethnicity, primary language), as well as district size and poverty level. Nonetheless, children from families who enroll them in preschool at 4 years old may differ in unmeasured ways from children who's families enroll them earlier, at 3 years old, or who do not enroll them, and these differences may contribute to the findings.

In sum, this study's findings indicate that there is good reason to provide high-quality preschool programs to 3-year-old children disadvantaged by poverty. The better early start in vocabulary development that preschool education can provide at age three can have important ramifications for children's subsequent learning. Whether similar gains in other areas such as children's print awareness and math skills might be produced with improvements in the program is an issue for further study. Policy makers and others should carefully consider the implications for early childhood program availability and funding, curriculum and professional development.

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Table 1. Statistical Results of ANCOVA Analyses

Measure	F (p)	Standardized Beta (p)
Receptive vocabulary standard scores	3.86 (.02)	1 year .952 (.35) 2 years 2.503 (.011) difference between 1 and 2 years -1.55 (.05)
Phonological skills - % correct	.39 (.68)	1 year 1.42 (.44) 2 years 1.46 (.41) difference between 1 and 2 years -.039 (.98)
Print Awareness skills - % correct	7.1 (.00)	1 year .047 (.01) 2 years .062 (.00) difference between 1 and 2 years -.015 (.26)
Math skills standard scores	5.65 (.00)	1 year 2.52 (.01) 2 years 3.05 (.00) difference between 1 and 2 years -.53 (.48)